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10/042,237	01/11/2002	Michael Seibert	12742-US	4832

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EXAMINER	
SINGH, RAMNANDAN P	

ART UNIT	PAPER NUMBER
2644	14

DATE MAILED: 04/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/042,237	SEIBERT, MICHAEL
	Examiner	Art Unit
	Ramnandan Singh	2644

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 January 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,4,10 and 11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4,10 and 11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 January 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

ELECTION OF SPECIES

1. This application contains claims directed to the following patentably distinct species of the claimed invention:

GROUP-I

Species I: Claims 3 and 17 are directed to a determinant of the matrix.

Species II: Claims 5 and 19 are directed to an eigen-decomposition of the matrix.

Species III: Claim 6 is directed to a single-valued decompositions (SVD)of the matrix.

Species IV: Claim 7 is directed to condition numbers of the matrix.

GROUP-II:

Species I: Claim 11 is directed to the time-domain elements of the matrix.

Species II: Claims 12 is directed to the frequency-domain elements of the matrix.

2. Applicant is required under 35 U.S.C. 121 to elect a single disclosed species from each of Group-I and Group-II for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, claim 1 is generic.

3. Applicant's response filed on 06 January 2004 confirmed the election of species I from Group-I. Further, as noted in the previous Office action, dated 06 October 2003, the Applicant elected claim 11 from Group-II. As a result, claims 5, 6, 7, 12 are withdrawn for further consideration by the Applicant. Hence this restriction requirement is made FINAL.

Response to Amendment

4. The amendment filed on 06 January 2004 is objected to under 35 U.S.C. 132 because it introduces **new matter** into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

A new Fig. 3 at step 12 states " Examine result of matrix operation **to determine correlation between components of matrix R**". The Examiner asserts that this matrix operation **"to determine correlation between components of matrix R"** is new matter, not supported by the disclosure. The Applicant has cited [Paragraph 0010] to support the introduction of this new matter [Applicant's response, Page 8]. The relevant portion of Paragraph 0010 is reproduced below:

" The correlation-based approaches taken in prior-art methods generally involve the calculation of a single cross-correlation coefficient, usually between R_{IN} and S_{IN}.

The problem with this technique is that the degree of correlation can very with different signals and echo paths. This makes it very difficult to set thresholds on the correlation coefficient in order to determine what state the echo canceller is in." Clearly, the degree of correlation is a function of different signals and echo paths. However, the requirement "**to determine correlation between components of matrix R**" is not present in the cited paragraph. As such, the Examiner considers "Fig. 3, at step 12" new matter.

Applicant is required to cancel the new matter in the reply to this Office Action.

5. Amendment to Fig. 1 as prior art is approved.

Response to Arguments

6. Applicant's arguments filed 06 January 2004 have been fully considered but they are not persuasive.

Applicant's argument—"In particular, Benesty does not propose establishing a matrix of signals from the filter and the signals from the echo path. These would be signals $\hat{y}(n)$, $y(n)$ in Benesty, who proposes using instead of $x(n)$ and $y(n)$. The fact that a computationally friendly double-talk detector can be obtained by generating a cross-correlation matrix of such signals X_0 and X_1 is clearly not taught in Ding or Benesty, either alone or in combination" on page 8.

Examiner's response—The Examiner disagrees. The Applicant is respectfully directed to the US Patent No. [US 5,206, 854] to Betts et al; and a relevant portion of this patent is cited below;

"The need to reliably detect the presence or absence of a remote signal in an echo-canceled signal is addressed, in accordance with the invention, by detecting a correlation between an echo estimate and the echo canceled signal. **Since the echo estimate is derived from a transmitted signal, which is the source of the echo signal, this correlation is effectively between the transmitted signal and the echo-canceled signal** and is representative of the amount of residual echo , or transmitted signal, present in the echo-canceled signal. As a result, the degree of correlation determines the presence or absence of a remote signal" [col. 2, lines 3-14].

Further, since the echo estimate, $\hat{y}(n)$, of Benesty is derived from a transmitted signal, x(n), which is the source of the echo signal, the Benesty's cross-correlation using a transmit signal, x(n), and a receive signal, y(n) is effectively the cross-correlation between the echo estimate, $\hat{y}(n)$, and the receive signal, y(n). In addition, Benesty et al have also provided motivation for using this cross-correlation approach based on x(n) and y(n), which has proven more robust and reliable [Benesty et al, page 168,col. 2, line 20-24].

7. **Status of Claims**

Claims 1, 3, 4, 10, 11 are amended.

Claims 5, 6, 7, 12 are withdrawn.

Claims 2, 8, 9, 13-22 are cancelled.

Claims 1, 3, 4, 10, 11 are pending.

8. **Change of Scope**

With the amendment to the claims, new grounds of rejection are made.

Claim Rejections - 35 USC § 103

9. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

10. Claims 1, 3, 4, 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding [US 6,226,380 B1] in view of Benesty et al [IEEE Trans. on Speech and Audio Processing; Vol. 8,No. 2, March 2000; pp. 168-172].

Regarding Claim 1, Ding teaches an LMS adaptive filter [Fig. 1] for generating an echo estimate and applying cross-correlation methods for detecting double-talk and path changes in an echo cancellation system [Figs. 1-2; col. 2, lines 48-52; Abstract]. Further, Ding discloses applying a cross-correlation criterion between various signals to arrive at a control decision [col. 2, lines 9-10]. In this invention, Ding generates vectors of an output signal, e(n), and an echo estimate, y(n), [see Fig. 1], and determines by comparing the absolute value of the cross-correlation, $R_{ey}(n)$, between the output signal and the echo estimate signal [Figs. 1-4; col. 2, line 59 to col. 3, line 40; col. 3, line 52 to

col. 5, line 23; col. 6, line 66 to col. 10, line 56]. It may, however, be noted that, although Ding teaches cross-correlation methods for detecting double-talk and path changes using a scalar and a vector, the methods can easily be generalized using scalars to a Vector, and vectors to a matrix which is well-known in the art [Benesty et al; IEEE Trans. on Speech and Audio Processing; Vol. 8,No. 2, March 2000; pp. 168-172].

Although Ding discloses applying a cross-correlation criterion between various signals to arrive at a control decision [col. 2, lines 9-10], he does not a cross-correlation using a transmit signal , x(n), and a receive signal, d(n). As a result, Ding does not teach expressly using a cross-correlation matrix based on vectors generated from x(n) and d(n) for detecting double talk and path changes.

Benesty et al teaches an LMS adaptive filter [see Fig. 1] for generating an echo estimate and applying cross-correlation methods, first using two scalar variables, namely, a transmit signal, x, and receive signal, y, as shown in Fig. 1, to generate a cross-correlation coefficient vector c_{xy} [Equation (3)], wherein decision rules based on characteristic value (i.e. **the absolute values of a cross-correlation coefficient**) for a detecting double-talk condition using a threshold are provided in Equation (4) [Pages 168-169]. Benesty et al further disclose extending the above decision rules [Equation (14)] using a normalized cross-correlation matrix, C_{xy}, between two vectors X and Y as given in Equation (13) for detecting different states of the echo canceller [Section III;

pages 169-170]. In reality, since the echo estimate, $\hat{y}(n)$, of Benesty is derived from a transmitted signal, $x(n)$, which is the source of the echo signal, the Benesty's cross-correlation using a transmit signal, $x(n)$, and a receive signal, $y(n)$ is effectively <u>the cross-correlation between the echo estimate, $\hat{y}(n)$, and the receive signal, $y(n)$</u> [See Paragraph 6 above].

Ding and Benesty et al are analogous art because they are from a similar problem solving area, viz. , detecting double talk in echo cancellation systems.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the cross-correlation matrix of Bensty et al with the Ding system as a generalized cross-correlation method.

The suggestion/motivation for doing so would have been to improve the performance of an echo canceller to detect double talk under echo path changes and provide <u>a more robust and reliable method</u> [Benesty et al; page 168, col. 2, lines 20-24; page 171, Fig. 2].

Regarding Claim 3, the combination of Ding and Benesty et al teaches a determinant of the cross-correlation matrix [Benesty et al; Equation (13)] to detect double talk and path changes [Benesty et al; Equation 14].

Regarding Claim 4, the combination of Ding and Benesty et al teaches applying a predetermined threshold for detection [Benesty et al; p. 171].

Regarding claim 10, the combination of Ding and Benesty et al teaches an adaptive filter wherein an adaptive algorithm such as NLMS (Normalized Least Mean Square) is applied [Ding; Fig. 1; col. 2, lines 18-33].

Regarding Claim 11, the combination of Ding and Benesty et al teaches a normalized cross-correlation matrix C_{xy} between two vectors X and Y in the time domain, wherein the X and Y are statistical variables [Benesty et al: Page 169, Equations (13-14); Section IV].

11. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ding [US 6,226,380 B1] in view of either Taguchi [US 5,062,102] or Sano [US 5,103,112].

Regarding claim 1, Ding teaches an LMS adaptive filter [Fig. 1] for generating an echo estimate and applying cross-correlation methods for detecting double-talk and path changes in an echo cancellation system [Figs. 1-2; col. 2, lines 48-52; Abstract]. Further, Ding discloses applying <u>a cross-correlation criterion</u> <u>between various signals</u> <u>to arrive at a control decision</u> [col. 2, lines 9-10]. In this invention, Ding generates vectors of an output signal, e(n), and an echo estimate, y(n), and determines by comparing the absolute value of the cross-correlation, $R_{ey}(n)$, between the output signal and the echo

estimate signal [Figs. 1-4; col. 2, line 59 to col. 3, line 40; col. 3, line 52 to col. 5, line 23; col. 6, line 66 to col. 10, line 56]. It may be noted that, although Ding teaches cross-correlation methods for detecting double-talk and path changes using a scalar and a vector, the methods can easily be generalized using scalars to a Vector, and vectors to a matrix which is well-known in the art [Applicant's Specification; page 8, lines 18-19].

Although Ding discloses applying <u>a cross-correlation criterion</u> <u>between various signals</u> <u>to arrive at a control decision</u> [col. 2, lines 9-10], he does not a cross-correlation using a transmit signal , x(n), and a receive signal, d(n). As a result, Ding does not teach expressly using a cross-correlation matrix based on vectors generated from x(n) and d(n) for detecting double talk and path changes.

Taguchi teaches an adaptive filter [see Fig. 1] for generating an echo estimate and applying cross-correlation methods based on a transmit signal, r(t), and receive signal, (s(t) + u(t)), as shown in Fig. 1, to generate a cross-correlation matrix [Equation (6)] wherein decision rules based on characteristic value (i.e. **the absolute values of a cross-correlation coefficient**) for a detecting double-talk condition using a threshold (i.e. **comparator 85)** [Figs. 2-3, 6, 8; col. 4, line 8 to col. 5, line 66; col. 9, lines 25-65].

Sano teaches a method and apparatus for echo cancellation (50) for detecting a double talk state using a cross-correlation matrix based on an transmit signal (IN) and a receive signal (EC) shown in Fig. 2. The method comprises generating a cross-

correlation value determiner (56) [Fig. 3] between the receive and transmit signals, and then uses a comparator 60 with a known threshold to detect various states of the echo canceller including a double-talk [Figs. 2-4; col. 3, lines 11-17; col. 5, lines 48-62; col. 7, lines 36-46].

Ding, Taguchi and Sano are analogous art because they are from a similar problem solving area, viz. , detecting double talk in echo cancellation systems.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the cross-correlation methods of either Taguchi or Sano with the Ding system as a cross-correlation method based on the transmit and receive signals.

The suggestion/motivation for doing so would have been either (i) to provide an echo canceller which is able to provide the optimum filter coefficients for a reduced or short time duration [Taguchi; col. 1, lines 53-54]; or (ii) to provide an arrangement which features a rapid detection of occurrence of double talk and hence is able to effectively prevent degradation of speech quality [Sano; col. 2, lines 37-40].

Conclusion

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ramnandan Singh whose telephone number is (703)308-6270. The examiner can normally be reached on M-F(8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Forester Isen can be reached on (703)-305-4386. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ramnandan Singh
Examiner
Art Unit 2644

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